

On report of the respective Committees, the following papers were ordered to be published in the Proceedings :

Description of a new species of CEPHALOPOD from the Coast of California.

BY W. M. GABB.

OMMASTREPES TRYONII.—Body large, subcylindrical for about two-thirds of its length, posterior third tapering, acute at the extremity. Fins between one-third and one-fourth the length of the body, nearly twice as broad as long, rhomboidal; angles rounded. Anterior of the body truncated at a right angle to the length and with a slight angle on the dorsal median line. Siphon short broad, head small, not wider than the body, flattened above (and at the sides?) Eyes small. Sessile arms robust, short, compressed: comparative length 4, 2, 1, 3, the dorsal being the shortest, although they are all of nearly equal length. The second and third pair are so compressed that the caps appear to be arranged in a single line. The lower half or two-thirds of the outer side of the dorsal and the whole of the same portion of the other arms are fringed with a narrow membrane. The inner side of the third pair is also fringed on each side of the cupules.

The cupules are all small, but the bordering rows of teeth are well marked. Tentacular arms compressed, very little longer than the longest pair of sessile arms. Cupules arranged on the distal two-fifths, largest in the middle, becoming very small towards each end. Mouth small, the surrounding membrane without cupules, with a bifurcating process between the dorsal pair of arms and one extending to each of the other sessile arms. Surface flesh colored, covered with small dots, sparsely placed on the lower side and pinkish; on the back these dots are nearly black and placed close together so as to produce a mottled appearance. Between the back and sides there is a well marked lighter band extending from the edge of the fins to the anterior end of the body.

Shell narrow, pointed in front and tapering backwards regularly, except the last half inch which is dilated into the usual slipper-like process.

Length of body 5.5 in.; circumference 3 in.; length of fin 1.8.; width of fin 3.4 in.; length of head .8 in.; breadth (about) .9 in.; length of longest sessile arm 2.1.; length of shortest 1.5 in.; length of tentacular arm 2.5 in.; length of siphon (about) .5 in.

Locality. Coast of California?

The specimen was presented to me by Dr. W. O. Ayres, of San Francisco, and was found in a lot of salt, most probably from near Point Conception. The colors are well preserved, but the specimen is so soft after relaxation that the exact form of the head cannot be determined.

It resembles *O. sagittata*, d'Orb., in both external form and the shape of the shell. It differs from that species, however, in the much shorter tentacular arms and the broader fin. The shell, which is pointed in nearly the same manner anteriorly, tapers regularly, while in d'Orbigny's species it is suddenly constricted.

On the Classification of the Families and Genera of the SQUALI of California.

BY THEODORE GILL.

In continuing at intervals the study of the Elasmobranchiate Fishes, I have felt obliged to modify several portions of the classification of the Squali that have been adopted in the "Analytical Synopsis of the order," from previous 1862.]

laborers on that group. Happily those families whose arrangement most requires modification are represented by species found along the coasts of California. I therefore, submit through the medium of a classification of those species, some of the changes which appear to be necessitated in the present state of our knowledge.

Order *SQUALI* (Müller et Henle) Agassiz.

Suborder *SQUALI* Gill.

Squalidæ veri *Bonaparte*, *Selachorum Tabula Analytica*, p. 4, 1838.

Pectoral fins produced directly outwards, or curved backwards from the anterior basal angle.

Caudal fin heterocercal and with a more or less developed inferior lobe procurrent forwards beneath the vertebral column.

Family *GALEORHINOIDEÆ* Gill.

Les Squales sp. *Cuvier*, *Regne Animal*, tome ii. p. 123, &c., 1817.

Squalidæ, (16) *Squalini*, (19) *Triænodontini* *Bonaparte*, *Selachorum Tabula Analytica*, p. 5.

Carchariæ part.

Triænodontes

Galei

Scylliodontes

Musteli

Nictitantes *Owen*, *Lectures on Comparative Anatomy*, vol. ii. p. 51, 1846.

Carchariidæ *Richardson*, *Encyclopædia Britannica*, vol. xii. (Ichthyology) p.

Galeidæ } 323.

Carchariodei } *Bleeker*, *Enumeratio Specierum Piscium hucusque in Archipelago*

Galeoidei } *Indico Observatorium*, &c., pp. 11, 12.

Galeorhinoidæ *Gill*, *Analytical Synopsis of the Order of Squali*, pp. 29, 30, 33.

Body elongated, subcylindrical, gradually tapering towards the caudal fin.

Scales minute, more or less rhomboid and imbricated, and generally surmounted by longitudinal keels.

Head more or less depressed and plane, oblong, semi-elliptical or conic above, with the snout projecting on the plane of the head, with its margin thin, more or less rounded, and declining obliquely backwards to the mouth.

Eyes lateral, submedian or anterior, with the nictitating membrane distinct.

Mouth inferior, large and arched in front.

Teeth compressed, with trenchant and entire or serrated edges (*Galeorhininæ*), or small and paved.

Nostrils inferior, and near the sides of the snout; simple and generally with a triangular flap from the anterior or inner border.

Spiracles, obsolete or developed.

Branchial apertures five, the last of which are small, and above the base of the pectoral fin.

Dorsal fins two; each is curved towards the anterior angle which is rounded and more or less projecting, especially that of the first fin, while the posterior angle is acutely produced backwards. First dorsal large and situated more or less in advance of the ventral fins; second moderate or small, and above or nearly above the anal fin.

Anal fin generally similar to the second dorsal in form and size, rounded at its anterior angle, and acutely produced behind.

Caudal fin decidedly heterocercal; the upper or vertebral lobe moderately elongated and abruptly curved upwards and backwards, and with the mem-

[Oct.

brane notched at its inferior margin near the end and forming a triangular lobe; the inferior or basal lobe is moderate or small.

Pectoral fins more or less falciform, rounded at the external angle, and with the posterior margin subtruncated or sinuated and incurved to the inner angle which is also rounded.

Ventral fins inserted more or less behind the middle, oblong or trapezoidal, rounded at the anterior angle and acute at the posterior.

The family of the Galeorhinoidæ as it has been now circumscribed, appears to be a very natural group, all the types included therein agreeing in physiognomy and general form, and for the most part differing from each other in details of secondary value. The only characteristics of greater than generic value are the more marked peculiarities of dentition, and the presence or absence of spiracles. Müller and Henle have attached much importance to such characters, and have regarded them as distinguishing five families. As, however, none of those characters are co-ordinate with others, the value assigned to them by those biologists appears to be much greater than they merit, and scarcely even sufficient to base subfamilies upon. The most important and trenchant variation in the family is found in the dentition of the genus *Mustelus* as opposed to that of all the other types. The latter may therefore be combined in one subfamily, while *Mustelus* can be regarded as the type of a second one. The typical subfamily of the *Galeorhininæ* is then subdivisible into four minor groups equivalent to families of Müller and Henle, and only characterized by the various combination of two characters. The following synoptical view will facilitate the recognition of the several groups.

I. Teeth compressed and trenchant..... GALEORHININÆ.

A. Spiracles obsolete in adults.

Teeth without lateral prongs..... Cynocephali.

Teeth with one or two lateral prongs on each side..... Triænodontes.

B. Spiracles developed.

Teeth with lateral prongs..... Scylliodontes.

Teeth without lateral denticles..... Galeorhini.

II. Teeth flat and paved..... MUSTELINÆ.

Subfamily GALEORHININÆ Gill.

Squalini	{	<i>Bonaparte</i> , <i>Selachorum Tabula Analytica</i> , p. 5.
Trænodontini		
Caschariæ sp.	{	<i>Müller and Henle</i> , <i>Systematische Beschreibung der Plagistomen</i> , pp. 28, 55, 57, 63.
Triænodontes		
Galei	{	
Scylliodontes		
Squaliana pt.	{	<i>Gray</i> , <i>List of the Specimens of Fishes in the Collection of the British Museum</i> , part 1, <i>Chondropterygii</i> , pp. 40, 51, 52, 55.
Leptochariana		
Galeiana	{	
Triakiana		
Galeorhininæ	<i>Gill</i> , <i>Analytical Synopsis of the Order of Squali</i> , pp. 33, 35.	

Teeth compressed and cultrate, smooth or serrated and with* or without lateral denticles.

Spiracles obsolete or of small size.

Group SCYLLIODONTES Müller and Henle.

Scylliodontes *Müller and Henle*, *Systematische Beschreibung der Plagistomen*, p. 63.

Scylliodontidæ *Girard*, *Explorations and Surveys for a Railroad Route, &c.*, vol. x. *Fishes*, p. 362.

Teeth scyllioid, or each one with one or two prongs on each side of the large central pointed one.

1862.]

Spiracles of small size, developed.

To this group are now referred two genera.

Genus RHINOTRIACIS Gill.

Body compressed, elongated and subfusiform in profile.

Scales tricarinated.

Head oblong, with the snout produced, oblong and attenuated towards the transversely rounded apex.

Eyes rather small.

Mouth moderate and boldly arched in front. The grooves at the corners are well defined and the upper lip folds over the lower.

Teeth with an acute median prong and a smaller lateral one on each side.

Nostrils nearer the mouth than the front of the snout, obliquely transverse and with a wide convex flap arising from the anterior or inner border of each aperture.

Dorsal fins nearly similar in form, obliquely produced upwards towards the anterior angle, which is rounded; acutely produced backwards from the posterior angle; the first dorsal is intermediate between the pectoral and ventral fins.

Anal fin similar to the second dorsal.

Caudal fin with a terminal triangular lobe, and with the membrane above the vertebral column moderately developed; inferior lobe scarcely produced downwards from the anterior angle.

Pectoral fin moderate, extensible partly under the first dorsal, rounded at each angle and subtruncated behind.

Ventral fins trapezoid, rounded at the external angle.

Rhinotriacis is very closely related to *Triacis*, but is separable from that genus on account of the produced snout, the position of the first dorsal fin and perhaps the greater development of the pectoral fins. It has a superficial resemblance to the genus *Isoplagiodon* of the group of Galeorhini produced by the situation of the first dorsal fin and the elongation of the snout, as well as its color, but the dentition, the presence of spiracles as well as the form and relative position of the fins at once distinguish it.

The only known representative of this genus is Californian; a single young specimen of the species was sent to the Smithsonian Institution by Mr. Samuel Hubbard, and referred to as a species with the aspect of *Isoplagiodon* immediately after the *Triacis semifasciatus*. It differs from the species of *Triacis* in color as well as morphological characters, being uniform reddish-brown above, and greyish-white below, with which color the pectoral, ventral and anal fins are also margined.

RHINOTRIACIS HENLEI Gill.

(The following table of measurements will suffice for the identification of the species. It is hoped that older specimens may be obtained in time to prepare a complete description for a work on the Fishes of Western America. The umbilical cord of the specimen noticed has entirely disappeared.

The base of each fin is considered as being on a level with the body; the height is measured in an oblique direction parallel with the axis of cleavage of the fin; the greatest breadth is parallel with the base or terminal margin, and crosses obliquely the line of cleavage.

Extreme length $9\frac{1}{4}$.

Body—Greatest height 10; greatest width 6; height of tail behind anus 4; least height of tail $2\frac{1}{4}$.

Head—Greatest length 18; greatest width 12; height of snout $7\frac{1}{4}$.

Eye—Diameter $4\frac{1}{2}$; distance from snout 9.

Mouth—Width $6\frac{1}{2}$; depth from symphysis of jaw to line between corners of mouth 3.

[Oct.

Dorsal—Distance from snout 30; length of base 10; length of horizontal "posterior" margin $4\frac{1}{2}$; greatest oblique height 9; (second) distance from snout 58; length of base 8; length of posterior (horizontal) margin $3\frac{1}{4}$; greatest (oblique) height 7.

Anal—Distance from snout 61; length of base 6; greatest height 4; height behind to point $3\frac{1}{2}$.

Caudal—Length 23; length of inferior lobe 15; oblique height of lobe near front 5; oblique height at end $1\frac{1}{2}$; greatest height of terminal lobe $3\frac{1}{2}$.

Pectoral—Greatest length $12\frac{1}{2}$; length within internal border 9; greatest width $8\frac{1}{2}$.

Ventral—Distance from snout 33; greatest length (from base to inside of outer angle) $5\frac{1}{2}$; length within internal border 4; greatest width 6.

Genus TRIACIS Müller and Henle.

Triakis Müller et Henle, Magazine of Natural History, vol. ii. 1838.

" Bonaparte, Selachorum Tabula Analytica, 1838.

" Müller et Henle, Systematische Beschreibung de Plagiostomen.

" Girard, Explorations and Surveys for a Railroad Route, &c., vol. x. Fishes, p. 362.

Body compressed, elongated and scarcely subfusiform in profile.

Scales provided with three keels producing a tridigitate margin.

Head scarcely oblong, with the snout short and transverse, the anterior margin being arched or convex.

Eyes rather small, and nearly above the angles of the mouth.

Mouth large and transversely arched. The groove at each corner of the mouth is very sharply defined, and the upper lip folds over the angle of the lower.

Teeth with a large acute median prong, and two smaller oblique ones on each side; the unpaired symphyseal tooth is symmetrical.

Nostrils nearer the mouth than the front of the snout, transverse and with a wide convex flap arising from the anterior (inner) border.

Dorsal fins similar in form, obliquely produced towards the anterior angle which is rounded; acutely elongated from the posterior angle; the first fin is rather nearer the ventrals than the pectorals; the second is smaller and partly in advance of anal.

Anal fin similar to second dorsal.

Caudal fin with a terminal triangular lobe, and with the membrane above the vertebral column moderately developed; inferior lobe obsolete or scarcely produced downwards and obtuse.

Pectoral fins rather small, rounded at each angle, not extending beyond the front margin of first dorsal.

Ventral fins trapezoidal, rounded at the external angle.

Type.—*Triakis scyllium* M. and H.

Two species of this genus are known; *Triakis semifasciatus* Girard, from California; *Triakis scyllium* Müller and Henle from Japan.

TRIACIS SEMIFASCIATUS Girard.*

Triakis semifasciatus Girard, Proc. Academy of Natural Sciences of Phila., vol. vii. p. 196, 1854.

Mustelus felis Ayres, Proc. California Academy of Natural Sciences, part 1, p. 17, 1854.

* The following name probably belongs to the synonymy of *Triakis semifasciatus*, but as it has never been joined to a description, the suggestion can be only verified by one having access to the British Museum. It is scarcely necessary to add that such a verification will not at all influence the nomenclature of the species, the name being a worthless synonym by default of description. *Triakis californica* Gray, List of Specimens of Fish, in the Collection of the British Museum, part 1, *Chondropterygii*, p. 56, 1851.

Triakis semifasciatus Girard, explorations and Surveys for a Railroad Route, &c.
vol. x. *Fishes*, p. 362.

Family *HETERODONTOIDÆ* Gill.

- Les Squales partim } *Cuvier*, *Regne Animal*, tome ii. 1817.
Squalus }
Cestraciontes *Agassiz*, *Poissons Fossiles*, tome ii. 1833.
Squalidæ veræ (Cestracionini) *Bonaparte*, *Selachiorum Tabula Analytica*, p. 5,
1838.
Squalidæ (Centrininæ) *Swainson*, *Natural History of Fishes*, &c., vol. ii. p.
1839.
Cestraciontes *Müller* and *Hentle*, *Systematische Beschreibung der Plagiostomen*,
p. 76, 1841.
Cestraciones *Müller*, *Arc.* 1, 1317, 1845.
Cestraciontidæ *Owen*, *Lectures on the Comparative Anatomy and Physiology of*
the Vertebrate Animals, p. 51, 1846.
Squalidæ (Heterodontina) *Gray*, *List of the Specimens of Fish in British Mu-*
seum. Chondropterygii, p. —, 1857.
Cestraciontoidæ *Bleeker*, *Systematis Piscium Naturalis Tentamen*.
Heterodontoidæ *Gill*, *Analytical Synopsis of the Order of Squali*, p. 29, 30, 37,
1862.
Squalidæ (Cestraciontini) *Bonaparte*, *Syst. Vert.*

Body elongated and obtusely trihedral, gradually tapering from the anal region towards the caudal fin.

Scales very small.

Head high, with the forehead declivous and the snout little prominent.

Eyes lateral, but very high on the sides; nictitating membrane obsolete.

Mouth subterminal but inferior and more or less arched in front.

Teeth in front compressed and trenchant or digitated, on the sides arranged in whorls, paved and adapted for grinding.

Nostrils continued backwards to the mouth.

Spiracles small.

Branchial apertures five, moderate or small; the last above the base of the pectoral fin.

Dorsal fins two, each well developed and with a spine enveloped in the front of its margin; the anterior angle of each is rounded, and the posterior acute; the first fin above the interval between the pectoral and ventral fins; the second more or less behind the ventral fins, and remote from the caudal.

Anal fin small or moderate, below or behind the second dorsal fin, and remote from the caudal; the anterior angle is rounded but produced, and the posterior blunt.

Caudal fin heterocercal; the upper lobe moderate and with its under edge notched and lobed nearer the end, and with the portion above the ventral column enlarged; the lower lobe is small or moderate.

Pectoral fins normally developed, with each angle rounded, but towards the anterior produced.

Ventral fins moderate, inserted nearer the head than the tail, with each angle obtuse.

The characters of the family of Heterodontoids as here exposed are derived almost entirely from our knowledge of the species living at the present day. The earliest known living representative of the family, the Port Jackson shark, has become celebrated on account of the views of Agassiz, by whom it was considered as the type and sole existing representative of a family rich in peculiar genera and species at former epochs of the world's history. That naturalist has proposed to refer to the family of Cestraciontes, numerous vestiges of the representatives of the order of Squali, found in every formation from the earli-

[Oct.

est period down to our own days. These vestiges are almost solely the more or less complete remains of teeth and spines. It is therefore by no means demonstrated that all such remains are indications of the pertinence of the species of which they are the witnesses, to the present family. All these remains require to be re-examined with reference to the present views held by naturalists regarding the nature of families. Such an examination will doubtless result in the disseverment of some of the genera known from such remains, from the family of Heterodontoids.

That family of Heterodontoids as now restricted, is distinguished among all the others representatives of the order by the peculiar form of the body and head. While in all the other recent sharks, the head is depressed and the snout above nearly parallel or on the same plane with the upper surface of the head, in the Heterodontoids, the head is elevated, the sides vertically expanded and the snout deflected downwards. The teeth form another very characteristic feature, those towards the front being incisorial or digitated, while those on the sides are molar and arranged in oblique whorls. Each dorsal is in front provided with a spine mostly enveloped in its substance, but with its point exposed. The simple teleological adaptation of the teeth of the ancient representatives of the Squali and their concurrence with spines have been the cause of the reference of those remains to the Cestracionts or Heterodontoids.

There are now known four living species of the family of Heterodontoids which appear to belong to three distinct genera, chiefly separated on account of the modifications of dentition, and the size of the branchial apertures. The several may be briefly distinguished by the following characters :

- I. Branchial region higher than long, the slits being elongated.. Heterodontus.
- II. Branchial region longer than high, slits little elongated.
 - α. Molar teeth rounded and carinated along the middle. Dorsals little produced towards the anterior angle. Tropicodorus.*
 - β. Molar teeth flat and closely contiguous. Dorsals produced backwards to the anterior angle..... Gyropleurodus.

Genus GYROPLEURODUS Gill.

Cestracion sp. *Girard*.

Heterodontus sp. *Gill*.

Gyropleurodus *Gill*, Proc. Academy of Natural Sciences of Phila., vol. xiv. p. 330, July (Sep.), 1862.

Body triquetrous in front, behind the anus attenuated and compressed towards the caudal fin.

Head short and high, broad, but with subvertical sides, with the forehead very declivous from eyes, and with the snout wide and transverse, but prominent. Two blunt diverging ridges are continued from each side of the snout and abruptly merge into the more conspicuous superciliary ridges, the interval between which is nearly plane. Inferior surface of head plane.

Eyes entirely lateral, protected above by the superciliary ridge.

Mouth inferior, but near the front, with the cleft semi-elliptical but externally transverse and simply arched in front. The branches of the jaws are separated by an ovate-triangular space, wide and rounded in front and thence curved outwards to the angles.

Teeth in front digitated with three or five cusps, quincuncially distributed in rows slightly converging towards the middle; in the upper jaw on the sides, molars oblong and flattened, arranged in about four oblique whorls, uniform or increasing backwards, except the last, which is smallest. On the sides of

* With this genus I am only acquainted through the figure and description of Valenciennes, who describes its type as the *Cestracion pantherinus* in the Ichthyology of the Venus, Voyage autour du monde sur le fregate la Venus, *Zoologie*, p. 350. *Ichthyologie*, pl. x. fig. 2.

the lower jaw also molars oblong, with flattened crowns, and arranged transversely oblique whorls, but decreasing backwards.

Upper lip narrow, emarginated in the middle, and with a median furrow; lower lip obsolete at middle, and developed laterally as a transverse flap, covered at the angle of the mouth by a duplicature or flap above.

Nostrils with a broad flap on the internal side, separated by a furrow from the lip, and with a roll of skin curled inwards on the external side.

Branchial apertures five, small and regularly decreasing in size, the branchial region being longer than high.

Dorsal fins rather large, similar in form, but first rather larger than second; each with a large compressed trihedral spine enveloped in the front margin, but separated partly by a slit and groove from the rest of the fin; the latter is recurved backwards towards the "anterior angle," which projects about as far behind as the posterior.

The present genus is an interesting addition to the living representatives of the ancient family of Heterodontoids, to which it belongs. It decidedly differs from *Heterodontus** in the development of the jaws, dentition and the size of the branchial apertures. In the latter genus, the branches of the lower jaw are at first contiguous and diverge from each other at an acute angle, while in front of the oblique whorls of molars and between the acute teeth of the front, which encroach on the sides, a cordiform area exists. The lateral or molar teeth are numerous and arranged in oblique whorls, which rapidly increase in size to the fifth, behind which they again decrease. The branchial apertures are also comparatively large, the first being longer than the length of the branchial region. In *Gyroleurodus*, the branches of the lower jaw are widely separated by an interval rounded in front and becoming wider behind, the sides themselves being curved outwards; the acute teeth are confined to the front, and the molar teeth are few and disposed in about four whorls, the first three of which slightly decrease, while the fourth is almost rudimentary. The branchial area is also almost oblong. There will be few, I think, who will not at once admit the value of these characters and allow their generic importance. Upon differences of much less value, many acknowledged genera of Squali have already been established.

The genus *Tropidodus*, established for the reception of the *Cestracion pantherinus* of Valenciennes, differs from *Gyroleurodus*, at least in the keeled and rounded molar teeth of the sides of the jaw, and the smaller dorsal fins, the anterior angles of which project comparatively little backwards.†

GYROLEURODUS FRANCISCI Gill ex Girard.

Cestracion francisci Girard, Proc. Academy of Natural Sciences of Phila., vol. vii. p. 196, 1854.

Cestracion francisci Girard, Explorations and Surveys for a Railroad Route, &c., vol. x. Fishes, p. 365.

Heterodontus francisci Gill, American Journal of Science and Art, ser. 2, vol. xxx. p. 281, 1860.

Gyroleurodus francisci Gill, Proc. Academy of Natural Sciences of Phila., vol. xiv. p. 330, 1862.

(On account of the interest attached to the representatives of the family of Heterodontoids, the following extended description of *Gyroleurodus francisci* is submitted.)

* The following is the diagnosis of the genus *Heterodontus*, published by Blainville:

69. *Heterodontus*. Car. Dent. heteroclitis; Insp. nullis; P. S. [Pinnis superioribus vel dorsalibus.] 2 ut in præcedenti; P. A. magna; P. C. ferè ut in præced.

Spec. Philippi.

† "Le bouche n'est pas très-large, elle parte en avant cinq à six rangs de petites dents aiguës, ayant à la base deux petits talons épineux, puis viennent sur les côtés des mâchoires six rangées de molaires arrondies et carénées sur le milieu."—*Valenciennes*.

Form.—The body is triquetrous in front, declining from the dorsal ridge to the sides of the plane abdomen. The greatest height equals an eighth ($\cdot 12$) of the total length from the snout to the vertical from the end of the caudal fin. The greatest breadth is a fourth greater ($= \cdot 15$) than the height. Behind the anus and ventral fins the tail becomes abruptly slender and compressed, the height entering fourteen times ($= \cdot 07$) in the length and about twice as high as at the base of the caudal ($= \cdot 03\frac{2}{3}$). The back in front of the dorsal gently declines and meets the forehead, from which it is separated by a slight groove, and is itself furrowed in the middle.

Head.—The head from the snout to the branchial region forms more than a sixth ($\cdot 17\frac{1}{2}$) of the length. The height at the forehead equals $\cdot 10\frac{1}{3}$, and at the margin of the superciliary ridge a ninth ($\cdot 11$) of the total length. The width between the external margins of the superciliary ridge nearly equals a twelfth ($\cdot 08$) of the same length, and the greatest width at the cheeks is nearly twice as great ($= \cdot 15$). The forehead or interorbital area is nearly plane between the superciliary ridges or scarcely convex along the middle. The superciliary ridges are blunt, very hard, angulated and obliquely truncated behind, and incurved inwards; they merge into the widening but less conspicuous ridges in front, which are continued to the snout, where they are separated by a shallow furrow and a slight depression; the rest of the profile is channelled. The cheeks are very tumid.

Eyes.—The eyes are oval; the longitudinal diameter between the skin about equals a sixth ($\cdot 03$) of the head's length, and that of the outer ring a fourth ($\cdot 04\frac{1}{3}$). The distance from the snout equals a half ($\cdot 09$) of the head's length.

Mouth.—The mouth is transverse, the margin of the lower jaw describing the three sides of a nearly regular octagon, and the distance from one corner to the other equals a twelfth ($\cdot 08$) of the total length, and four-fifths of the width of the head at the same vertical. The patch of teeth encroaching on the outside of that jaw is transversely fusiform.

Teeth in front of each jaw digitated, with a median cusp and two on each side, which become lateral and directed outwards on teeth next to the symphysis; they are arranged in five rather oblique rows, each row in the upper jaw having six on each side of the symphyseal ones, and in the lower, four. The area with molar teeth equals in length the width between the lower lips.

Fins.—The first dorsal originates at the vertical from the beginning of the last third of the base of the pectoral fin, or near the front of the second fourth of the total length ($27\frac{1}{3}$). Its attached base nearly equals a twelfth ($\cdot 08$) of the same length, and the free-extension backwards to the posterior angle a sixteenth ($\cdot 06$). The spine is rectilinear, rather exceeds a tenth of the length, and its compressed base forms half of the base of the fin itself. The margin of the fin describes a parabolic curve backwards to the "anterior angle," which is obliquely rounded and projects rather farther backwards than the "posterior angle;" the latter is little acute, and the margin between it and the anterior is vertical and little emarginated. The greatest (oblique) height rather exceeds an eighth ($\cdot 13$) of the total length.

The second dorsal is similar in form to the first, but less elevated in proportion, and with the anterior angle not extending beyond the posterior, and the emargination deeper. The distance from the snout exceeds a half ($\cdot 54$) of the total length, and that from the posterior angle of the first dorsal equals the base of that fin to such angle. Its base equals about a fourteenth ($\cdot 07\frac{1}{2}$) of the length, and the posterior angle extends nearly a nineteenth ($\cdot 05\frac{1}{3}$) more behind. The spine is rather more oblique than that of the first dorsal; its base forms two-thirds of that of the entire fin, and its length equals a tenth of the total. The greatest (oblique) height of the fin equals a ninth ($\cdot 11$) of the total length.

The anal fin commences at the middle between the sixth and seventh-tenths ($\cdot 65$) of the length, or rather in advance of the posterior angle of the second
1862.]

dorsal; it is directed very obliquely backwards and passes slightly beyond the base of the caudal; its greatest (oblique) height rather exceeds a ninth of the length, and its base equals about a twentieth; the anterior angle is broadly rounded and passes much beyond the posterior; the (oblique) height behind equals the base, or a twentieth of the length.

The caudal fin is bent obliquely upwards, and its (oblique) length nearly equals a fourth ($\cdot 24$) of the total; the vertebral column is regularly attenuated and disappears near the truncated posterior margin; the elevation above the lower boundary of the column is slightly greater behind the middle of the fin, and equals almost a twentieth of the total length. The greatest height or width of the upper caudal lobe, just before its vertically truncated end, is rather less than a tenth ($\cdot 09\frac{1}{2}$) of the length; its angles are rounded; the distance from the base of the lower lobe to its upper angle enters about five times and two-thirds ($\cdot 17\frac{1}{2}$) in the length; the posterior margin is slightly oblique and emarginated; the upper angle extends rather beyond the lower; the greatest depth (or width) in front of the angles is rather more than a tenth ($\cdot 10\frac{1}{2}$) of the length.

The pectoral fin is subtriangular; the outer margin is first curved and thence is produced in nearly a straight line outwards and backwards to the external angle; the posterior border is nearly straight and scarcely more produced towards the exterior than the inner angle; the latter is more broadly rounded than the outer; the distance from the front of the base to the outer angle is little less than a quarter of the length ($\cdot 24\frac{1}{2}$), and a fourth greater than the distance from the same point to the margin outside of the inner angle ($= \cdot 18$), or the width of the fin before the angles ($\cdot 18$). The fin extends almost as far backwards as the posterior angle of the first dorsal.

The ventral fins originate at the beginning of the second-fifth ($\cdot 40$) of the total length and considerably behind the vertical from the "anterior angle" of the first dorsal; they are oblong, quadrangular, slightly overlapping towards the middle of the inner borders, slightly emarginated and with the angles equally rounded; the length equals an eighth of the total and the greatest breadth almost an eleventh.

Scales.—The scales are more or less cruciform or shaped like a Greek cross, and often with each end divided. They are rather small, there being about forty oblique rows beneath the attached base of the first dorsal fin. Those on the inferior surface of the body and of the pectoral and ventral fins, as well as the anal and caudal, are polished and more or less cordiform.

Color.—The color is brownish, variegated with sparsely-scattered, small black spots on the entire body and fins.

Family NOTIDANOIDEÆ Owen ex M. and H.

Les Squales partim } *Cuvier*, Regne Animal, tome ii. p. 123 (128), 1817.
Squalus }

Squalidæ veræ (Notidiani) *Bonaparte*, Selachorum Tabula Analytica, p. 4, 1838.

Notidani *Müller and Henle*, Systematische Beschreibung der Plagiostomen, p. 80.

Squalidæ (Hexanchina) *Gray*, List of Species of Fish in British Museum.

Chondropterygii, p. 40, 67, 1851.

Notidanidæ *Owen*, Comparative Anatomy of the Vertebrated Animals, vol. i. p. 51, 1846.

Notidanoidei *Bleeker*, Systematis Piscium Naturalis Tentamen.

Notidanoideæ *Gill*, Analytical Synopsis of the Order of Squali, p. 38; *ib.* in Annals of the Lyceum of Nat. Hist. of N. Y. vol. vii. p. 404.

Body elongated, somewhat depressed before, tapering towards the caudal fin. Scales minute and generally pointed and traversed by one or three keels. Lateral line present on each side of the back.

Head depressed, oblong and semi-oval or semi-elliptical above, with the snout projecting, indicated by more or less distinct constriction at the anal

[Oct.

region, with its margin rounded, and thence declining very obliquely backwards to the mouth.

Eyes submedian or anterior, without nictitant membranes.

Mouth inferior, ample and arched in front.

Teeth in the lower jaw compressed, transverse and acutely multicuspid; in the upper dissimilar.

Nostrils inferior, provided at the upper front or margin with a small flap.

Spiracles, small.

Branchial apertures all in advance of and dissimilar in size to the pectoral fins; in the known species there are six or seven on each side.

Dorsal fin single, angulated and produced toward the anterior angle, acute at the posterior above or in advance of the anal; first obsolete.

Anal fin present, similar in form to the dorsal.

Caudal fin heterocercal; the vertebral lobe is moderately elongated, and has beneath near its end a small triangular lobe; the inferior basal lobe is moderate or small.

Pectoral fins moderately developed, rounded at each end produced towards the external.

Ventral fins normally developed, inserted as near or nearer the head than the tail, rounded at the anterior and acute at the posterior or inner angle.

The family of the Notidamids is distinguished from all others of the order by the absence of the first dorsal fin. The increased number of branchial apertures, the dentition, common to all of its known species, and the form of the head and body support the claims of the group to family rank. The situation of the branchial apertures in front of the pectoral fins recalls a character of the Lamnoideæ, a family including the Porbeagle, great white shark and basking shark.

Genus NOTORHYNCHUS, Ayres.

Notorhynchus Ayres, Proc. California Academy of Natural Sciences, vol. i. p. 72, 1855.

Heptanchus, sp. *Müller and Henle, Gray, Girard, Gill.*

Body depressed over abdomen, thence becoming subcylindrical and tapering backwards.

Dorsal line conspicuous.

Head oblong, depressed and ovoid above, with the snout wide, and with its periphery transversely rounded, but more or less constricted at the nasal region, and very prominent.

Eyes moderate, over or in advance of the middle of the side of the jaws.

Nostrils at horizon of eyes, more or less in advance of mouth, oblique and with a small triangular flap on the hinder margin.

Teeth of the upper jaw chiefly developed at the front on each side of the symphysis (2—3) simple, acute and curved outwards, or rectilinear with the bases increasing outwards as the teeth severally recede from the symphysis, first (1—2) assuming a smaller external pointed cusp and thence becoming still wider and pectinated on their obliquely declining margins on the outer side of the greater cusp; those at and near angle formed by the front and side of jaw bone serrated, and one or two small cusps on the inner ascending margin of the greater one; teeth of the laterals of the jaw rather abruptly decrease in size. Teeth of the lower jaw uniform, broader, each obliquely diminishing in height outwards, digitated by oblique cusps decreasing from the first, which is minutely serrated on its ascending margin; median unpoised tooth small, with no median cusp but two or more directed outwards.

Dorsal fin moderate, acutely angulated at its posterior angle and obliquely emarginated above.

Anal fin about as large as dorsal, rather further behind, but partly under it, with the anterior angle less produced.

1862.]

Caudal fin elongated, with the anterior lobe in front produced downwards and nearly rectangular, and with the terminal one distinct and acutely triangular.

Pectoral fins moderate, trapezoid produced towards its external terminal angle.

Ventral fins oblong, emarginated along its external border, acutely produced at its inner or produced angle.

This generic name of *Notorhynchus* was proposed by Dr. Ayres, under a misapprehension, for a species which is congeneric with one regarded by all previous naturalists as a species of the genus *Heptanchus*. After an examination of the jaws of a shark presumed to belong to the species noticed by Ayres, and presented at Nisqually to one of the representatives of the Exploring Expedition under Commodore Wilkes, I am compelled to believe that such species should be separated from *Heptanchus*. The name of Ayres must then be adopted for the genus embracing that species.

Notorhynchus may be briefly characterized as a *Hexanchus* in form and dentition with the seven branchial apertures of *Heptanchus*. If the totality of its character is considered to be of more importance than the number of branchial apertures, *Notorhynchus* is then more closely related to *Heptanchus*, having the same form of the head and the same dentition, while it agrees with the latter only in the number of its branchial apertures.

In addition to the type of the genus, that species of the East Indian Seas first made known by Müller and Henle under the name of *Heptanchus indicus* must be referred to *Notorhynchus*. Like *Notorhynchus maculatus*, the East Indian species is spotted, and although it appears to differ considerably from the former in dentition, that difference cannot be regarded as being of more than specific importance.

The differences in the dentition of the genera *Heptanchus* and *Notorhynchus* principally refer to the relative development of the teeth of the lower jaw and their armature. In *Heptanchus*, the developed teeth on each side of that jaw regularly increase in breadth from the symphysis towards the corners of the mouth, the inner cusp is much enlarged, and its ascending or inner margin is armed with one or two smaller cusps. The median tooth of the lower jaw is also well developed and has a central acute cusp. In *Notorhynchus*, on the contrary, the teeth of the lower jaw are either uniform or decrease towards the corner of the mouth, the cusps on the oblique cutting margin are regularly graduated, while the ascending inner margin of each tooth is finely serrated. The median tooth is also emarginated instead of cuspidate at its own middle. The difference between the teeth of the upper jaw in the respective genera is of much less importance.

The typical or Californian species of *Notorhynchus* is closely related to the *Notorhynchus indicus*, but is at once distinguishable by its dentition,—the teeth of the lower jaw being comparatively broader and less elevated, and armed with six or seven points instead of five, and there being no very prominent denticles on the inner margin of the upper teeth near the front ones as there are in those of *N. indicus*. The dorsal appears also to be nearer the snout than it is in its Indian representative.

The *Notorhynchus maculatus* is said by Ayres to be “apparently not uncommon in the Bay of San Francisco, at certain seasons of the year.” It attains to a length of six or seven feet, and is used as food by the Chinese inhabitants of California.

It will be necessary to bear in mind that the description of the dentition of *Notorhynchus maculatus* is based on the jaws of a specimen obtained at Nisqually by the Exploring Expedition under Commodore Wilkes. There can be little doubt as to the specific unity of the different materials, but as Dr. Ayres' notice of the dentition is equally applicable to any species of the family, the correctness of this identification still requires to be verified.

[Oct.

NOTORHYNCHUS MACULATUS Ayres.

Notorhynchus maculatus Ayres, Proc. California Academy of Natural Sciences, vol. i. p. 72, 1855.

Heptanchus maculatus Girard, Explorations and Surveys for a Railroad Route, &c., vol. x. Fishes, p. 367.

$$\begin{array}{c} | \quad 3^1 + 2^2 + 3^4 + 3^m \\ \text{Dent. } + \frac{\quad}{\quad} \\ 6 \quad | \quad 1 \end{array}$$

The first three teeth on each side of the symphysis are on an arch more advanced in front than the others; they successively increase in size and each has a quadrate bony base from which the enamelled cusp slightly curves outwards and backwards, and whose internal margin is common to it at the base, while the external angle of the latter is more and more produced laterally. The two (or three) succeeding teeth are nearly similar and have a much smaller acute cusp at the outer base of the primary one; the fifth or outermost of the two bicuspid teeth is wider and much shorter than the preceding, slightly serrated in its ascending margin, and equals in size the next; the succeeding are finely serrated on the internal basal half of the cusp, while the oblique margin on the outer side of the cusp is armed with very oblique, small and successively decreasing denticles; the seventh and eighth teeth being alike armed with two or three such denticles directed outwards, while the third is broader with a smaller cusp and an obliquely descending inner margin armed with three or four denticles; the three succeeding teeth (9—11) are smaller, and the great cusp successively becomes smaller and nearer the centre of the teeth. Behind are nine or ten small, wide tubercular teeth.

There are six teeth on each side of the lower jaw, uniform in shape, very wide, obliquely declining sideways or outwards, and generally with seven graduated cusps, the first of which is largest and the outermost rudimentary and horizontal. The obliquely ascending inner margin of each tooth is gibbous or curved near the jaw and finely denticulated along most of its edge. The osseous portion is much more developed than the enamelled part and is about twice as wide as high. Next to each corner of the jaw are about nine rudimentary tuberculous teeth.

Family *SPINACOIDÆ* (Owen,) Gill ex Müll. and Henle.

Les Squales partim } *Cuvier*, Regne Animal, tome ii. p. 123 (129) 1817.
Squalus }

Squalidæ veræ (Spinacini) *Bonaparte*, Selachorum Tabula Analytica, p. 4, 1838.

Spinaces *Müller* and *Henle*, Systematische Beschreibung der Plagiostomen, p. 83.

Squalidæ (Anacantiana) *Gray*, List of Specimens of Fishes in British Museum. Chondropterygii, pp. 40, 69.

Spinacidæ *Owen*, Comparative Anatomy of the Vertebrated Animals, vol. i. p. 51, 1846.

Spinacoidei *Bleeker*, Systematis Piscium Naturalis Tentamen.

Spinacoideæ *Gill*, Analytical Synopsis of the Order of Squali, pp. 29, 31, 38; *ib.* in Annals of the Lyceum of Nat. Hist. of N. Y., vol. vii. p. 395, &c.

Spinax (genus) *Cuvier*, Regne Animal, ed. 1, tome ii.

Body more or less elongated, obtusely trihedral or subcylindrical and fusiform, gradually tapering behind.

Scales variable.

Head depressed, oblong and transversely rounded, or obtusely produced in front, with the snout projecting along the plane of the forehead, and below declining backwards to the mouth. Eyes lateral, anterior or submedian, with no nictitating membrane.

1862.]

Mouth inferior, large or moderate, and more or less arched in front.

Teeth compressed, and with the edges consequently trenchant or blunt, and entire or serrated; supplementary prongs are frequently present at their bases.

Nostrils inferior and lateral near the front margin of the snout.

Spiracles present and moderately developed.

Branchial apertures moderately fine on each side, all of which are in front of the pectoral fins.

Dorsal fins two, each armed in front with a spine, which is more or less exposed; the anterior angle of each fin is more or less rounded, and the posterior acutely produced backwards; the first is above the space between the pectorals and ventrals; the second more or less behind the latter.

Anal fin obsolete.

Caudal fin obliquely truncated or emarginated, with the upper lobe obtusely angulated at its extremity; lower lobe obsolete or rudimentary.

Pectoral fins normally developed, obtusely angulated at the external angle, and rectangular or acutely produced at the interval.

Ventral fins inserted far behind and nearer the tail than head.

The family of Spinacoids, as it has been here restricted, is equivalent to the genus *Spinax* of Cuvier, and embraces only those forms agreeing in physiognomy, the shape of the several fins, and the relations of the dorsal spines to their fins. The genus *Oxynotus* of Rafinesque or *Centrina* of Cuvier is consequently excluded from it. That genus has a very characteristic aspect resulting from the decided trihedral form of the body and the acute back, the opposition of the second dorsal and ventral fins, and the abrupt attenuation of the tail behind as well as from the shape of the fins, and the insertion of the spines of the dorsal fins. These characters appear to indicate that *Oxynotus* is less closely related to the Spinacoids than has been generally supposed, and that it is rather the representative of a peculiar family; such being the case, the family thus recognized should receive the name of *Oxynotoideæ*. The Scymnoids are still less allied to the Spinacoids than the Oxynotoideæ, as they differ in the form of the head and fins as well as in the total absence of spines from the front margin of the dorsal fins. The Echinorhinoids are still more widely separated by the form of the fins as well as the posterior position of the dorsal and ventral ones.

The family of Spinacoidæ as now restricted appears to be represented at the present day by six genera, which may be briefly distinguished by the characters exhibited in the analytical synopsis herewith given. This arrangement differs considerably from that of Müller and Henle and their successors.

A. Teeth without supplementary lateral cusps. Scales cordate or rhomboid.

α. Teeth similar in each jaw, with the incisive margin horizontal, and terminated at the outer angle in an acute point, directed outwards.

1. Ventral fins nearly intermediate between two dorsals; pectoral fin obtusely angulated at the inner angle; caudal fin with an entire upper lobe..... Squalus.

2. Ventral fins little before the second dorsal; pectoral acutely produced at inner angle; caudal with a terminal inferior lobe..... Entoxychirus.

β. Teeth in upper jaw oblique or vertical.

1. Teeth in upper jaw vertical and acute, somewhat inflated on each side of the base; those of lower jaw with the points directed obliquely outwards, serrated on the incisorial or inner margin, and inflated on the outer side of the base. Scales very small and rhomboid..... Centrophorus.

[Oct.

2. Teeth of upper jaw oblique, with the inner margin continuous from the base; those of lower jaw with the points directed obliquely outwards, and with entire inner incisoral edges. Scales rather large, cordate and keeled along middle..... Lepidorhinus.
- B. Teeth in upper or both jaws digitate or with a large acute central cusp, and one or more smaller acute cusps on each side, as in *Scyllium*. Scales hair-like or quadrangular with an upright point.
 1. Teeth of upper jaw only digitated; of lower like those of *Squalus*. Scales hair-like..... Spinax.
 2. Teeth of both jaws digitated. Scales quadrangular, each with an upright point..... Centroscyllium.

Genus SQUALUS (Artedi,) Raf.

Squalus Artedi, Linn.

Squalus Rafinesque, Caratteri di alcuni nuovi generi e nuovi specie, &c., p. 12, 1810.

Acanthorhinus Blainville, Journal de Physique, &c., tome lxxxiii. p. 263, (type *S. acanthias*.) Oct., 1816.

Les Aiguillats (*Spinax*) *Cuvier*, Règne Animal, ed. 1, vol. ii. p. 129, 1817.

Acanthias Bonaparte, Selachorum Tabula Analytica.

Body fusiform, slender, with the caudal peduncle also elongated and slender.

Scales cordiform or heart-shaped, with a middle point, and one or more keels on each side.

Head oblong-ovate and flattened, with the muzzle projecting and subconic, but blunt at its extremity.

Eyes above the mouth, longitudinal and with subcircular pupils, flop from the nostril, nearer the snout than the mouth; each with a produced border.

Spiracles large behind and slightly above the eyes, crescentiform convex in front and with a valve at its front margin.

Mouth little arched in front. Labial cartilages two above and one below.

Corner pits of the mouth large and obliquely point outwards and backwards.

Teeth nearly similar in each jaw, subquadrate, with the incisive edge nearly horizontal, and at the external angle terminating in a point directed outwards and separated by a notch from the body. The root of each tooth is higher on its inner side than its outer, and has on the former a longitudinal keel; on the outer forms a round ledge towards the point of the tooth.

Dorsal fins moderate, with a nearly naked spine in the front margin, each fin rounded at its anterior angle, and with the posterior acutely extended backwards. First dorsal larger, much nearer to the pectorals than the ventrals. Second, far behind and with the spine proportionately larger.

Caudal fin with the upper lobe much developed and the membrane increasing in height towards the end above the caudal vertebræ, rounded at its end and regularly incurved to the sinus separating it from the lower lobe which is moderately developed. Tail pits developed at least at the base of the upper caudal lobe.

Pectoral fins produced at the external angle, which is rounded, and incurved at nearly right angles to the inner angle, which is more or less blunt.

Ventral fins submedian, little nearer to the second dorsal than the first, obtusely angulated in front, and acutely angulated behind.

The claspers of the male are furnished on the exterior side near the end with a moveable prickle or spine whose tip is curved.

Type.—*Squalus acanthias* Linn.

The present genus is here restricted more precisely than has been done, 1862.]

under the name of *Acanthias*, by Müller and Henle, and has the same limits that appear to have been intended for it by the Prince of Canino. It embraces only those species which possess all the characteristics assigned to the genus *Acanthias* by Müller and Henle, and which in addition agree in the relative situation of the ventral fins, and the form of the pectoral and caudal fins. The *Squalus uyato* of Rafinesque is thus excluded. This species differs from *Squalus acanthias* and the allied species, by the distinct terminal lobe with which the caudal fin is provided, the obtuseness of the external angle of the pectoral, and the acute prolongation of the internal one, as well as the posterior insertion of the ventrals, those fins being but little in advance of the second dorsal. The transverse grooves or pits at the base of the caudal fin are also obsolete. It cannot be doubted, that this combination of characters is indicative of generic distinction from the *Squali*. The *Squalus uyato* should then be regarded as the type of a peculiar genus, and in allusion to one of the characters which distinguishes it from *Squalus*, it may be named *Entorychirus uyatus*. This species has been referred with doubt to the genus *Spinax* as distinguished from *Acanthias*, by Bonaparte, but it evidently does not belong to that group, and is more nearly allied to the latter, in which it has been placed by Müller and Henle.

The name of *Squalus* has been retained for this genus instead of *Acanthias*, because it was first restricted to the group.

The genus *Squalus* of Artedi and Linnæus was equivalent to the order of *Squali*; its species were distributed by Rafinesque among a number of smaller groups or genera, and by him the name was first retained for those species which are deprived of an anal fin and have a blunt back. As Rafinesque was perfectly justified in this limitation, the name of *Squalus* must be preserved for a portion of that group, and having been first in this limited sense applied to the species with spinous dorsals, must be so retained. Rafinesque's genus *Squalus*, however, was co-extensive with the fourth section of Müller and Henle, after the exclusion of the genus *Centrina* and the family of *Squatinae*; it embraced all the species with an obtusely trihedral or subcylindrical body and without an anal fin. At the same time, under a misapprehension, supposing that some species were destitute of spiracles, he referred them to another genus called *Dalatias*, not perceiving the identity of those species with some that he had already placed in the genus *Squalus*.

In 1816, Blainville proposed the generic name *Acanthorhinus* for a group which is co-equal with *Squalus* and *Oxynotus* of Rafinesque, referring to it all the species of *Squali* without an anal fin, and with the first dorsal fin on the back, in contradistinction to *Echinorhinus* in which both dorsals are on the tail.* *Squalus* was not retained as the name of a subgenus.

Again, in the following year, Cuvier distributed the same representatives of the suborder *Squali* among three genera; *Spinax*, distinguished by the presence of dorsal spines, and the advanced insertion of the ventral fins; *Centrina*, with spinous dorsals the second of which and the ventrals were opposed to each other, and *Scymnus*, the dorsals of which were unarmed. He likewise omitted to retain the Artedian name for any minor group or subgenus of *Squali*.

The name of *Spinax* was retained unaltered for the group so called until the Prince of Canino, in 1838, restricted it to the *Squalus spinax* of Linnæus, and referred the *S. acanthias* to a new genus which was named *Acanthias*. These names were retained for those groups till 1862.

In the "Analytical Synopsis of the order of *Squali*," the history of the nomenclature of the genera of that order was briefly discussed, and it was urged

* *l*°. *Acanthorhinus*, Car. Dent. var.; Insp. magnis; P. S. 2, 1, in dorso; 2, magna; P. A. nulla; C. lata, bifurcata, lobo sup. brevi. Cute asperissima.

Spec. *Acanthias*; *Ferdinandinus*; *Assieri*; *Spinax*; *Norwegianus*; *Americanus* aut *Nicensis*; *Microcephalus*; *Centrina*; *Squamosus*; *Granulosus*; *Cepedianus*; *Blochianus*. (*Journal de Physique*, &c., lxxxiii. p. 263)

that the Artedian name should be reserved for the genus to which it was first restricted by Rafinesque. Blainville's name of *Acanthorhinus* and Cuvier's of *Spinax*, consequently were referred to it as synonyme.*

The genus *Squalus* as now understood contains four species.

Squalus acanthias Linn. Europe generally.

Squalus americanus Gill = *Acanthias americanus* Storer. Eastern America.

Squalus sucklii Gill = *Acanthias sucklii* Girard. Western America.

Squalus blainvillii Gill = *Acanthias blainvillii* Risso. Mediterranean sea.

SQUALUS SUCKLIi Gill.

Spinax (*Acanthias*) *sucklii* Girard, Proc. Academy of Natural Sciences of Philadelphia, vol. vii. p. 196, 1854.

Acanthias sucklii Girard, Explorations and Surveys for a Railroad Route, &c., vol. x. Fishes, p. 368.

Acanthias sucklii Suckley, op. cit., vol. vii. book ii. p. 367.

Suborder RHINÆ Gill.

Squalidæ anomalæ Bonaparte, Selachorum Tabula Analytica, p. 4, 1838.

Pectoral fins produced forwards from the anterior basal angle, while the produced portion is separated from the nape by a cleft, in which the branchial apertures are lodged.

Caudal fin terminal and nearly homocercal, being nearly equally developed above and below the vertebral column.

This suborder is most nearly allied to the order of Raia. The rays sometimes present as a monstrosity a separation of the pectoral fins by a cleft from the neck somewhat similar to the mode found as a normal feature in the Rhinæ. The nominal genus *Propterygia* of Otto is founded on such a monstrous example of a species of *Raia*.†

Family RHINOIDÆ Gill.

Squatina Cuvier, Règne Animale.

Squalidæ anomalæ (*Squatina*) Bonaparte, Selachorum Tabula Analytica, 1839.

Squatina Muller and Henle, Systematische Beschreibung der Plagiostomen.

Raiidæ (*Squatina*) Swainson, Natural History of Fishes, vol. ii. 1839.

Squatina Owen, Lectures on Comparative Anatomy, vol. ii. 1844.

Squatinoidei, Bleeker, Systematis Piscium Naturalis Tentamen.

Rhinoideæ Gill, Analytical Synopsis of the Order of Squali, pp. 30, 31, 42, 1862.

Body depressed, rather rapidly diminishing in width behind the ventral fins towards the caudal.

Scales minute and conical.

Head depressed, about as wide as long, rapidly decreasing in width to the snout, which is transversely truncated or bluntly rounded. Eyes on the dorsal surface of the head and near the snout.

Mouth terminal, transverse.

Teeth subconical or impressed and slightly trenchant.

Nostrils terminal, in front of the upper lip.

Spiracles well developed and behind the eyes, from which they are quite remote.

Branchial apertures five, approximated, and in front of the base of the pectoral fin, in a cleft between the anterior projection, of which, and the neck they stand.

* Bonaparte afterwards adopted the name of *Spinax* for the genus still retained under that appellation, but the genus should be credited to him.

† See also "Nota sopra una singolare mostruosità di una razza del Dottor F. de Filippi," &c., in Nuovi Annali delle Scienze Naturali di Bologna, Feb. 1852.

Dorsal fins rather small, placed far back on the tail and behind the ventral fins; each angle is rounded, and the anterior project backwards.

Anal fin obsolete.

Caudal fin small and emarginated, with its lower lobe equal to or larger than its upper.

Pectoral fins much developed, subrhomboidal, extending forwards from the base and separate by a cleft from the neck. The external angle is obtuse and the inner rounded.

Ventral fins much developed, rounded at the external and produced at the internal, nearer the head than the caudal fin.

Genus RHINA Klein.

Squalus, sp. *Artedi*, &c.

Rhina Klein, *Historiæ Piscium promovendæ missus tertius de piscibus per branchias occultas spirantibus*, 1742.

Squatina Dumeril, *Zoologie Analytique*, 1806.

Rhina Rafinesque, *Caratteri di Alcuni nuovi Generi e nuove specie*, &c., p. 14, 1810.

Squatina Rafinesque, *Blainville*, *Cuvier*, *Risso*, *Lesueur*, *Fleming*, *Jenyns*, *Müller* and *Henle*, *Bonaparte*, &c.

Rhina Gill, *Catalogue of the Fishes of the Eastern Coast of North America*.

Body elongated and depressed, rather abruptly attenuated towards the caudal fin behind the ventrals and carinated on each side.

Scales conical, terminating in a fine point.

Head transverse, suborbicular, at the neck slightly constricted, and with the snout transverse. Each side furnished with a cutaneous ledge running from the external corner of the nostrils to the branchial fissure.

Eyes small, circular, in a line with the nostrils and spiracles and nearly equally remote from each.

Spiracles crescentic and convex before. Upper lip broad.

Cartilages of the mouth two above as well as below.

Nostrils in the anterior border of the upper lip, notched in the middle, and provided on each side with a flap, the external of which is broad and indented, and the interval divided into several scalloped lappets.

Teeth conical, little trenchant, scattered and absent at the symphysis of both the upper and lower jaw.

Dorsal fins nearly equal, small, and nearly equidistant from each other, the ventrals and the caudal; the angle is rounded and projects backwards as far as the rounded posterior angle.

Caudal fin emarginated with obtuse lobes, the lower of which is larger.

Pectoral fin large, produced towards the external angle, and broadened at the inner.

Ventral fins oblong, rounded at the anterior or external angle, and acutely produced towards the inner.

The genus *Rhina* is the only existing representatives of the family of which it is typical, and is readily recognizable by its peculiar form. In allusion to that form, the vulgar namer of Angel fish has been applied to it, the physiognomy of the species recalling to the mind of the people the figures of "*Cherubim*."

Six species of this genus are more or less perfectly known. They are distributed in all the temperate seas of the Northern hemisphere. Three species have been assigned to the Mediterranean sea.

Rhina squatina Raf. ex Linn.

Rhina oculata Gill = *Squatina oculata Bon.*

Rhina fimbriata Gill = *Squatina fimbriata M. and H.*

One species closely related to the *R. squatina* and formerly confounded with it is found at Japan.

[Oct.

Rhina japonica Gill = *Squatina japonica* Bleeker.

Another species also nearly allied to the *R. squatina* is found along the eastern coast of the United States.

Rhina dumérili Gill = *Squatina duméril* Les.

A sixth has been described as an inhabitant of the California seas.

Rhina californica Ayres = *Squatina californica* Ayres, olim.

The name of a species (*Squatina angelina* Gray,) inhabiting the Caribbean sea has been published in Gray's Catalogue of the Chondropterygians, but not the slightest diagnosis has been given.

RHINA CALIFORNICA Ayres.

Squatina californica Ayres, Proc. of the California Academy of Natural Sciences, part 2, p. 29, 1859.

Rhina californica Ayres, Proc. of the California Academy of Natural Sciences, part 2, p. 54, fig. 7, 1861.

On the limits and affinity of the Family of LEPTOSCOPOIDS.

BY THEODORE GILL.

In the Proceedings of the Academy of Natural Sciences for April, 1859, (vol. xi. p. 282,) there has been first made known a peculiar type (*Dactyloscopus tridigitatus*) of fishes having the general appearance of a Uranoscopoid, but distinguished by the structure of the ventral fins, each of which had three simply articulated rays like those of the Blennioids. "Notwithstanding the abnormal and blennioid structure of the ventrals," the new type was said to agree in all other characters, except dentition and the origin of the dorsal fin, with a species referred to the genus *Uranoscopus** by Sir John Richardson; it was consequently referred next to that fish, but as the type of a distinct subfamily, (*Dactyloscopinæ*), the species of Richardson being also considered as the type of another peculiar subfamily, (*Leptoscopinæ*.)

In the "Annals and Magazine of Natural History," for February, 1860, (vol. iii. p. 86,) Günther described a type which differed from *Leptoscopus* and agreed with *Dactyloscopus* in the want of palatal teeth.

In a subsequent "Synopsis of the Uranoscopoids," published in the Proceedings of the Academy for May, 1861, (vol. xiii. p. 108,) the correctness of the approximation of the *Dactyloscopinæ* next to *Leptoscopinæ* was still further insisted upon, and both were retained in the same family with the *Uranoscopinæ*.

In the third volume of the "Catalogue of the Acanthopterygian Fishes in the Collection of the British Museum," *Dactyloscopus* was referred to the Blennioids, and interposed between *Tripterygium* and *Dictyosoma*. Dr. Günther remarked, that "*Dactyloscopus* has been referred by Gill to the *Uranoscopina*,† from which, however, it differs in several cardinal characters. The structure of the dorsal and ventral fins is that of a Blennioid. The absence of *pseudo-branchiæ* is very peculiar; but in this respect it differs equally from the *Uranoscopina* and Blenniidae."‡§

The *Uranoscopinæ* formed a "group" or subfamily of the family of Trachinidae as understood by Günther.

* *Leptoscopus macropygus*.

† The group *Uranoscopina* of Günther, which is equivalent to the family of *Uranoscopoids*, after the elimination of the species with less than five ventral rays, is meant, and not the subfamily of *Uranoscopinæ* as restricted by Gill.

‡ Günther, op. cit., iii. p. 279.

§ In his remarks on the family Blenniidae, Dr. Günther has observed that the value of the development of the *pseudo-branchiæ*, as a character of that family, "appears not to be sufficient, *Dactyloscopus* and *Putecus* forming exceptions, although the structure of their dorsal fin proves that their natural place is with or near the Blennioids." The real structure of the dorsal of *Dactyloscopus* proves the contrary; the natural place of *Putecus* is rather near, than with, the Blennioids. (*Gemypterus* is a Chilian *Ophidioid*; *Loarces* and *Lycodes* form a peculiar family, all wanting true dorsal spines.)